RAIL-ROAD MACHINES FOR MAINTENANCE WORK IN RAILROAD TUNNELS
No. E-03-0002 June 2017 March 2018

ISRAEL RAILWAYS LTD.
INFRASTRUCTURE DIVISION

Technical Specification
for
Rail-Road Machines for
Maintenance Work in
Railroad Tunnels

Version 1

No. E-03-0002

June 2017 March 2018
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1. **General**

1.1. In order to perform the maintenance work of various utility systems in the railroad tunnels and tracks of ISR.

1.2. ISR is interested in purchasing Rail-Road Vehicles fitted to transport the maintenance teams and equipped with the necessary devices to perform the maintenance of the aforesaid systems.

1.3. The Rail – Road Machine including the Host Vehicle shall be built according to the relevant European Norms and Standards.

2. **Relevant Standards (non exhaustive list):**

The machine shall fully comply with the latest edition of:

2.1. **Directive 2007/46/EC**

2.2. EN 14033-1:2009 Railway applications-Track- Railbound construction and maintenance machines –part 1: Technical requirements for running.


2.5. EN 13715 Railway applications – Wheelsets and bogies –Wheels-Wheels tread.


2.8. EN 15437 (all parts) Railway applications – Axlebox condition monitoring – interface and design requirements.

2.9. EN 15528 Railway applications – Line categories for managing the interface between load limits of vehicles and infrastructure.


2.17. EN 50238:2003 – Railway applications – Compatibility between rolling stock and train detection systems.

2.18. EN 60947 (all parts) – Low voltage switchgear and controlgear.


2.21. UIC 545 – Brakes – Inscriptions, marks and signs.

2.22. All EN and UIC mentioned in this technical description.

3. **Terms and Definitions**

3.1. **Road-rail machine** – self-propelled machine that can run on rails or ground.

3.2. **Trailer** – non self-propelled machine that can be hauled on rail wheels.

3.3. **Mobile elevating work platform (MEWP)** – mobile machine intended to move persons to working positions where they carry out works from the work platform with the intention that the persons get on and off the work platform at one defined access position, and which consists at a minimum of a work platform with controls, an extending structure and a chassis.

3.4. **General attachment** – components or assembly of components which can be mounted onto the machine or equipment for a specific use.

3.5. **Railway specific attachment** – equipment capable of being temporarily fixed to and/or powered from the machine, but specifically excludes lifting accessories.

3.6. **Host vehicle** – basic road vehicle or machine which is converted to run additionally on rails.

3.7. **Manufacturer** – body that designs and constructs a rail-road machine, or converts the original machine/vehicle to a road-rail machine.
3.8. **Running configuration** – state of machine when it is on the rail and all movable parts are stowed and secured within the applicable kinematic gauge in accordance with ISR requests.

3.9. **Working configuration** – state of machine as soon as any part of the machine or of its equipment is away from the running configuration.

3.10. **On and off tracking configuration** – configuration of the machine when it is in a state that enables it to be on or off track.

3.11. **Running** – moving the machine in running configuration along the track.

3.12. **Operating track** – track corresponding to the criteria of the infrastructure manager on which vehicles may run under normal signaling arrangements (with or without speed limits).

3.13. **Working track** – track being maintained for which the geometrical parameters may reach the limiting values as specified in EN 14033-2:2008, annex F and for which special operational restrictions may apply.


3.15. **Operator** – person who handles the controls of the machine in order to perform the functions of the machine.

3.16. **Driver** – person who handles the controls of the machine in order to control the machine in running configuration along the track.

3.17. **Special train** – assembly of vehicles/machines attached by couplings to a category 9 machine, and conforming to the relevant requirements of the infrastructure manager.

3.18. **Rated load** - load that the lifting equipment has been designed for normal operation and the manufacturer states can be lifted in any specified position.

3.19. **Type testing** – examination of the first machine of a new type, for build conformity to the requirements of EN 15746_1:2010.
3.20. **Type conformance testing** – procedure to verify that the machine conforms to the design of the first machine of the type that has been approved.

3.21. **Type approval certificate** – document issued after the checking of documents and/or testing of the vehicles in which the agreement of the running of the machine in the infrastructure is confirmed.

3.22. **Visual test** – exam to establish whether all elements of the machine, system or component are present and that documents and drawings correspond to the requirements.

3.23. **Measurement test** – test to establish whether the stated measurable parameters have met the requirements such as geometric dimensions, safety distances, insulation resistance of the electric circuits, noise, vibrations etc.

3.24. **Functional test** – test to establish whether, in unloaded working conditions, the machine including all safety devices, works as intended and all functions comply with the requirements of the technical documentation.

3.25. **Load test** – test to establish whether the strength and stability of the equipment under load together with all safety devices and adjustments meets the requirements of EN 15746 (all parts).

4. **General Requirements**

4.1 The machine shall be a category 9A machine according to EN 15746, built on the basis of a road lorry as host vehicle able to perform all the tasks mentioned in this technical specifications.

4.2 The machine shall be able to work both in running track and in working track.

4.3 The machine shall be able to travel and work on OCS - electrified lines 25000 V 50 Hz AC.
4.4 The travel speed on track shall be 40 km/h in forward direction and 20 km/h in reverse direction. The speed on the road shall be between 90 to 100 km/h.

4.5 The machine shall have the capability of towing a rail trailer with a total weight of approximately 20 ton with a speed of 20 km/h on a gradient of 40‰ by means of a Rockinger coupler and a towing bar.

4.6 The host vehicle and the general attachments such as cranes shall have local service representatives capable of providing maintenance for the specific system.

4.7 The host vehicle shall be of the latest type in production at the time of award.

4.8 Components of the rail road machine and of all systems which are obsolete, nearing end of production or out of production shall not be used.

4.9 All components shall remain and be readily available for the ISR to purchase for a minimum of twenty (20) years from the date of FAT. Components which are obsolete, nearing end of production or out of production shall not be used.

4.10 The host vehicle shall have frame and suspension configurations designed to work both on and off-road.

4.11 The bogies or axles intended for traveling on rail will be activated by hydrostatic motors.

4.12 The visibility of the driver when driving and working shall comply with EN 15746 – 2.

4.13 For driving in the reverse direction, a CCTV according to EN 15746-2 shall be provided.

4.14 When running on railway wheels, the road wheels will be positioned 100 mm higher than the top of the rail.
4.15 Track gauge - 1435 mm.

4.16 Max longitudinal gradient 40‰.

4.17 For the requested loading gauge see Annex A.

4.18 For the cross section of the tunnel see Annex B.

4.19 The operating parameters in ISR running track are:

<table>
<thead>
<tr>
<th>4.19.1. Track gauge</th>
<th>1435 [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.19.2. Travel speed - self propelled</td>
<td>at least 40 km/h</td>
</tr>
<tr>
<td>4.19.3. Max gradient</td>
<td>40 [%]</td>
</tr>
<tr>
<td>4.19.4. Min curve radius on shunting area</td>
<td>75 [m]</td>
</tr>
<tr>
<td>4.19.5. Min curve radius on main and secondary track line</td>
<td>140 [m]</td>
</tr>
<tr>
<td>4.19.6. Max superelevation</td>
<td>170 [mm]</td>
</tr>
<tr>
<td>4.19.7. Electrification system OCS</td>
<td>25 kV , AC , 50 Hz</td>
</tr>
<tr>
<td>4.19.8. Standard height of contact cable</td>
<td>5.5 [m]</td>
</tr>
<tr>
<td>4.19.9. Minimum OCS height</td>
<td>5.25 [m]</td>
</tr>
<tr>
<td>4.19.10. Maximum OCS height</td>
<td>5.6 [m]</td>
</tr>
</tbody>
</table>

5. Limiting Parameters for Traveling and Working on the Working Track.

5.1. The limiting geometric parameters for machine travelling and working in working track are the parameters mentioned in annex F of EN14033-2 namely:

<table>
<thead>
<tr>
<th>Track geometry parameter</th>
<th>Limiting value for working track</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1. Twist on base of 3 m</td>
<td>10 mm/m</td>
</tr>
<tr>
<td>5.1.2. Twist on base of 9 m</td>
<td>5 mm/m</td>
</tr>
<tr>
<td>5.1.3. Cant</td>
<td>200 m</td>
</tr>
<tr>
<td>5.1.4. Length of ramp</td>
<td>≥ 5 m</td>
</tr>
<tr>
<td>5.1.5. Ramp gradient</td>
<td>≤ 20:1000</td>
</tr>
<tr>
<td>5.1.6. Lateral radius of curvature</td>
<td>≥ 50 m</td>
</tr>
<tr>
<td>Track geometry parameter</td>
<td>Limiting value for working track</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>5.1.7. Over 10 m chord</td>
<td>50 mm (peak to peak)</td>
</tr>
<tr>
<td>5.1.8. Lateral displacement of the track</td>
<td>500 mm / 20 m</td>
</tr>
<tr>
<td>5.1.9. Gradient</td>
<td>see EN 14033-1</td>
</tr>
<tr>
<td>5.1.10. Vertical radius of curvature</td>
<td>see EN 14033-1</td>
</tr>
</tbody>
</table>

The twists according 5.1.1 and 5.1.2 shall be added for the construction of the machine.

5.2. The host vehicle engine shall comply with the newest European Union regulations, EURO 6B category of engine emissions, or most recent.

6. **Elements of the Machine**

6.1. The machine shall be composed of the following elements:

6.1.1. The host vehicle will be a regular road lorry which will be converted for travelling on the track by means of suitable railway bogie or axles with railway type wheels.

6.1.2. The railway wheels shall not interfere with the correct functioning of the axle counters.

6.1.3. The host vehicle shall have automatic transmission.

6.2. The cabin

6.2.1. The vehicle shall have a cabin fit to transport 8 people (driver/operator and seven additional people).

6.2.2. The cabin shall be equipped with a tropicalized air conditioning system able to provide the necessary air conditioning for the crew and for the correct functioning of the electric and electronic systems mounted in the cabin conform with EN 14033.

6.2.3. The driver's controls will comply with EN 15746-2 section.

6.2.4. A driver vigilance system (SiFa) shall be provided for driving position in rail mode.

6.2.5. The driver and assistant will be protected against solar radiation by means that will not change perception of signal colour.
6.3. The machine shall be equipped with an independent electric generator by 10 kVA.

6.4. The electric generator shall be able to work continuously for at least 10 (ten) hours.

6.5. The vehicle shall be equipped with a crane with work basket with dimensions LxWxH: 2000 x 1500 x 1200 able to carry workers, tools and parts needed for maintenance work.

6.6. The crane shall have a work radius of at least 7 (seven) meters.

6.7. Loading weight of working basket shall be at least 500 kg.

6.8. The working basket shall have a rotation device to permit rotation in horizontal plane for infinite working angles.

6.9. In working mode the basket shall be maintained horizontal balanced.

6.10. The basket shall be equipped with an intercom to the driving cabin.

6.11. Compressed air and hydraulic lines for activation of working tools shall be provided in the cradle.

6.12. The working basket shall have at least two electrical sockets to 220V/25A for powering electrical tools.

6.13. There will be possible to drive the machine by remote control from the cradle at a creeping speed of 3 to 5 km/h.

6.14. This crane shall be positioned on the vehicle near the rear end of the cabin.

6.15. At the rear end of the vehicle shall be another crane with a hydraulic articulated boom capable of lifting 3000 kg at a distance of 10 m (30 t-m) the crane shall be able of rotating 400º.

6.16. The crane shall be provided with a suitable hook.
6.17. This crane shall have also the possibility to be operated by remote control by an operator positioned outside the machine.

6.18. There will be possible to operate the two cranes simultaneously or separately.

6.19. A lighting system suitable for illuminating the work place shall be provided on the cradle.

6.20. Storage boxes for tools and parts shall be provided on the vehicle.

6.21. On the platform of the vehicle there will be a free space of 2.5 m long for transport of parts e.g. a point machine.

6.22. The platform of the vehicle shall have demountable side walls.

7. Stowing of Moveable Parts in Running Configuration

When the machine is in running configuration any movable equipment which has the capacity to go outside the gauge shall be stowed in a safe manner according to EN 15746-1 section 5.5.2.1.

8. Movement Limiting Devices

Where operation of the machine or any device or attachment mounted on the machine exceeds the working limits, the accidental intrusion in the dangerous zones should be prevented by movement limiting devices conform to EN15746-1 section 5.2.3.2.2.

9. Continuing the Railway Traffic on the Adjacent Line

The machine will be designed so as to allow continuing the rail traffic operation on the adjacent track.
10. **Working Limit on the Lower Area**

   The machine shall be designed and built so as not to damage infrastructure elements, such as axle counters etc., during work.

11. **Working Limit in the Upper Area**

   11.1. All metallic parts of the machine shall be equipotential bonded to rail according to section 5.17.1 of EN 15446-1.

   11.2. The machine shall have the possibility to travel on electrified lines but **will not be allowed** to work under live catenary.

12. **Interaction with the Infrastructure**

   The interaction with the infrastructure shall comply with section 5.4 of EN 15746-1 and the relevant sections of EN 14033-2 for category 9A machines with speed less than 60 km/h on track.

13. **Lifting and Jacking Points**

   Lifting and jacking points shall be fitted as per section 5.8.2 of EN 15746-1.

14. **Rail Wheels**

   14.1. Rail wheels shall be suitably loaded to provide good rail guidance at all times.

   14.2. Any failure of the suspension system shall not make the machine unstable when operating at the limits of its rated load and/or reach.
15. **Braking**

15.1. The machine shall comply with the braking requirements given in EN 15745-2 section 5.24.

15.2. The machine shall also comply with the braking requirements of the host vehicle when in road mode.

15.3. The manufacturer shall insure the machine complies with requirements of 5.24.1.

15.4. The stopping distances are given in the following table:

<table>
<thead>
<tr>
<th>Machine speed [km/h]</th>
<th>Maximum stopping distance on level track of machine and any permitted (by the manufacturer) unbraked trailing road [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
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<td>16</td>
<td>18</td>
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<td>30</td>
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<td>32</td>
<td>60</td>
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<td>40</td>
<td>90</td>
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<td>50</td>
<td>155</td>
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<tr>
<td>60</td>
<td>230</td>
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<tr>
<td>70</td>
<td>300</td>
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<tr>
<td>80</td>
<td>400</td>
</tr>
<tr>
<td>90</td>
<td>500</td>
</tr>
<tr>
<td>100</td>
<td>620</td>
</tr>
</tbody>
</table>

Note

a) It is accepted by some infrastructure managers that tests are carried out on a known slope and to calculate the equivalent stopping distance on flat track.

b) For Category 9B machines the manufacturer shall design the braking system to ensure that the coefficient of friction between
road and rail wheel is greater than 0.3 and thus will be the limiting factor for grip.

15.5. A parking brake capable of operating and function without power from the machine shall be provided capable of holding the machine in rail configuration on a gradient of 40‰ according to EN 15746-2 section 5.24.3.

16. **Visibility and Audibility of the Machine**

The visibility and audibility of the machine in working and running modes shall comply with clauses 15.5 and 15.6 of EN 15746-1.

17. **Electrical Equipment and Earth Bonding**

17.1. Equipotential bonding shall comply with EN 15746-2 section 5.16.8.

17.2. Antennae shall comply with EN 15746-2 section 5.16.9.

18. **Electromagnetic Compability**

The machine shall meet the requirements of clause 5.18.1 and 5.18.2 of EN 15746 – 1 concerning emissions from the machine and immunity of the machine from railway equipment.

19. **Operation of Axle Counters and Treadles**

The machine shall not have any metal parts, other than the wheel flanges in the axle counter detection area. The interference zone according to EN 50238:2003 shall be kept free.
20. **Failure Recovery Condition of the Machine**

The machine shall have adequate means to be moved in case of failure, including emergency devices which will be part of the tool kit of the machine.

21. **On and Off Tracking of the Machine**

21.1. The system of placing the machine on the track or to remove it from the track including the use of turntables shall comply with section 5.22 of EN 15746-1.

21.2. There will be a possibility of achieving the running mode even with failure of main power source. To this aim, an auxiliary power source may be installed.

22. **Cranes and Lifting Devices Fixed on the Machine**

The cranes and lifting devices fixed on the machine shall comply with the requirements of section 6.2, 6.3 and 6.4 of EN 16746-2.

23. **Exhaust**

23.1. The exhaust gases shall not be directed to catenary nor to the working places of the operators.

23.2. The machine shall be equipped to minimize the emissions of internal combustion engines.

24. **Production Process**

24.1. **Quality Control**
Together with the proposal the contractor shall submit to ISR a
copy of his quality control manual. The following procedures must
be included in the manual:

24.1.1. Tests Plan
Listing all the tests that will be performed by the
contractor on the vehicle during the production, including
tests at major sub contractors. Submit a sample test plan.
The actual test plan shall be submitted 15 days after
contract award.

24.1.2. Final Test Details
The final test of the vehicle shall be conducted following
the guidelines of EN 15746.
Submit a sample final test plan. The actual test plan will
be submitted one month before commencement of the
test.

24.1.3. Deficiencies Tracking Procedures
The quality control manual will show the procedure how
the contractor tracks and closes deficiencies that were
discovered during the manufacturing process. The
deficiencies will include among other parameters at least
the following:
   a. Deficiency Description;
   b. Remedial Plan.

24.2. Manufacturing Schedule
24.2.1. Within 15 days after contract award the contractor shall
present his manufacturing schedule. The schedule shall
show the timing and duration for the following tasks that
will take place with the participation of ISR personnel.

24.2.2. Design review.
24.2.3. Foreign acceptance test at manufacturer's premises.
24.2.4. Final vehicle systems tests at ISR premises and tracks.

24.3. Handing-over Procedure
The handing-over procedure shall include the following tasks:

24.3.1. At the manufacturing plant:
   a. Visual check of the vehicle and its systems for
      compliance with the specifications drawings and the
      submittals.
b. Checking of all test reports which were issued during the production for compliance with the test plan.

c. Running test of the vehicle and its systems.
   A representative of the Notified Body will participate in this test and will certify that all propulsion, driving, braking, towing, visibility, vigilance meet the EN and the UIC codes and are functioning properly according to EN 15746.

d. The certification price shall be included in machine price.

e. Checking of all the hard copies of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements.

f. Checking of all the Interactive Electronic Technical Manual (IETM) of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements and its hyperlinks and search capabilities.

g. After approval of all the tests by ISR the vehicle shall be sealed, protected and prepared by the contractor for the sea transportation.

24.3.2. At destination:
   Tasks to be performed by the contractor
   a. Removal and cleaning the vehicle packaging and inhibiting materials.

b. Functional tests of all vehicle systems.

c. Operators and maintenance personnel training – 15 working days for operators and 15 working days for maintenance team.
   The manufacture will submit a proposal for the training as mentioned above for ISR approval

25. Technical Documentation

The manufacturer will provide the technical documentation requested in section 8.2 of EN 15746-2 and section 7 of EN 15746-1 and annex---of this technical sp20.   Documentation Requirements.
26. **Documentation Package**

26.1. The documentation will be provided in English and in Hebrew, both in softcopy and hardcopy formats. The documentation package will include:

26.1.2. Operator’s Manual for the machine and all systems.
26.1.3. Maintenance Manual for the machine and all systems which shall include all the preventive maintenance activities and repairs.
26.1.4. Engineering documentation including special processes for overhauling maintenance.
26.1.5. Pneumatic, hydraulic and electrical detailed diagrams and integrative drawings.
26.1.6. Illustrated parts catalog for all levels of repairs.
26.1.7. Fault diagnosis and troubleshooting charts for each system/sub-system.
26.1.8. Inspection procedures and maintenance standards.
26.1.9. Table of service tools & equipment.

26.2. Operators manual

The User Handbook / Operator’s Manual should include the following information:

26.2.1. Front cover page.
26.2.2. Opening pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
26.2.4. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, technical data.
26.2.5. Chapter 3 – Controls, displays and HMI.
26.2.6. Chapter 4 – System Operation: All operating sequences, steps before placing the system in service, system
operation, system shutdown and steps after taking the system out of service.

26.2.7. Chapter 5 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.

26.2.8. Chapter 6 – Troubleshooting: For both BIT and symptom-based troubleshooting, includes all troubleshooting instructions, charts etc.

26.2.9. Chapter 7 – Maintenance: Includes all maintenance activities of the user.

26.3. Maintenance manual
The Maintenance Manual for each level of repair should include the following information:

26.3.1. Front Cover Page.

26.3.2. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.).


26.3.4. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, theory of operation (General Block Diagram, Functional Description), interfaces, technical data.

26.3.5. Pneumatic, oil, fuel, electrical and other systems will also be described according to their functional circuits.


26.3.7. Chapter 4 – Troubleshooting: Both BIT and symptom-based troubleshooting, including all troubleshooting instructions, screens, charts, fault diagnosis and use of any special maintenance tools ("Special Tools") or testing equipment.

26.3.8. Chapter 5 – Maintenance: Includes all maintenance activities for Preventive Maintenance and Corrective Maintenance, such as inspections and maintenance
tasks, repair procedures, material used, procedures for assembly and disassembly of sub-systems, assemblies and sub-assemblies, calibrations, topping of consumables etc.

26.4. System Description manual
The System Descriptive Manual should include the following information:
26.4.1. Front Cover Page.
26.4.2. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.).
26.4.3. Main systems detailed description (engine, fuel, oil, pneumatic etc.).
26.4.4. Software main modules description (power up, BIT etc.).
26.4.5. Hardware main modules description (EMDEC, Control cards etc).
26.4.6. Appendixes.

26.5. NOTE: The Template for the ISR technical manual will be provided on demand.

26.6. Documentation Formats
Documentation will be provided in the following formats:
26.6.1. All the documentation shall be supplied as:
a. Hard copies in the quantities detailed hereafter.
b. Source files (MS Office, Indesign etc.).
c. PDF files (unlocked and data-copy-enabled).

27. **Training Package Requirements**

27.1. Training Package
Training materials shall be provided for operation, maintenance, in the English language, both in softcopy and hardcopy formats. The training package shall include:
27.1.1. Training schedule.
27.1.2. Theoretical lessons.
27.1.3. Practical lessons.
27.1.4. Job Aids.
27.1.5. Evaluation package.

27.2. Training Package Formats
The Training Package will be provided in the following formats:
27.2.1. User Handbook / Operator’s Manual, Maintenance Manuals will be supplied as:
   a. PowerPoint files for Theoretical Lessons.
   b. WORD files for Practical Lessons.
   c. PDF files (unlocked and data-copy-enabled).

27.3. Manufacturer Training Courses
24.3.1 The Manufacturer is requested to conduct several training courses in the English language:
   a. Operators Course.
   b. Maintenance Course.

27.4. The courses will include both theoretical and practical aspects. Course outlines should be approved by ISR Training department in order to ensure that all aspects are covered.

28. Certification of the Machine

28.1. The manufacturer shall propose and ISR shall approve a notified body that will perform the certification of the machines according to EN 14033 and EN 15746.
28.2. The notified body will perform a type testing for the first machine and will provide a test type certificate and will perform type conforming testing for the remainder of the machines.
28.3. The cost of the testing will be included in the price of the machines.
ANNEX A

Loading Gauge

Standard gauge ISR

---

1. 3.800 m - for permissible speed greater than 160 km/h up to 250 km/h.
2. 3.300 m - for speed greater than 60 km/h up to 160 km/h.
3. 0.000 m - for speed up to 60 km/h on the secondary lines, station and marshalling yards.
4. Dimensions for new rolling stock. For existing rolling stock high and wide of maximum loading gauge for coach/loco - 4.750 m and 1.660 m.
5. Dimensions for infrastructure gauge.
6. Dimensions for Rolling stock static gauge.
A. Area between tracks or outside of track for signaling equipment.
B. Area for passenger platforms, ramps, and signaling systems.

Comments:
1. Dimensions on this sketch for straight line only.
2. Calculation of this dimensions in curve (see technical rules ISR).
3. Location of structures on the passengers platforms in relation to terminal tracks (see technical program for passenger station ISR).
4. All basic dimension of the ISR infrastructure reference profile follows the EN 152273 standard.
5. The ISR infrastructure gauge refers to GC Reference Profile.
ANNEX C

Climate and Environmental Conditions

Max. Ambient temp. +50 °C (shade)
Min Ambient temp. -5 °C
Relative humidity 10% to 90%
Altitude - 400 m to +800 m
Sunny hours per year 3300
UV Radiation MJ/m² per year 360-600
Rainfall mm/year 400-800

(Dust Conditions in the atmosphere)
(Microgram per m³ atmosphere)

<table>
<thead>
<tr>
<th></th>
<th>Maximum Half-hour Value</th>
<th>Maximum Daily Value</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>1064</td>
<td>560</td>
<td>71</td>
</tr>
<tr>
<td>SO2</td>
<td>780</td>
<td>260</td>
<td>21</td>
</tr>
<tr>
<td>O3</td>
<td>312</td>
<td>143</td>
<td>84</td>
</tr>
<tr>
<td>Suspended Dust</td>
<td>350</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Suspended Particulate Matter (SPM)
Particle size 0.5-1 micron
Sea Salt Concentrations in the Atmosphere
(Micrograms per m³ atmosphere)

<table>
<thead>
<tr>
<th>Salt Element</th>
<th>Na</th>
<th>Cl</th>
<th>SO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>Wet</td>
<td>Dry</td>
</tr>
<tr>
<td>Sea Air at Coast Line</td>
<td>7.3</td>
<td>16.0</td>
<td>12.0</td>
</tr>
<tr>
<td>600 m from Shore</td>
<td>3.1</td>
<td>4.8</td>
<td>4.2</td>
</tr>
<tr>
<td>6000 m from Shore</td>
<td>1.1</td>
<td>1.4</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Attachment D

Clarifying Technical Details after Clarifications Process
(Representing an Integral Part of the Technical Specifications)

1. The electric systems shall be designed in accordance with the relevant EN standards. Systems operates by means of alternating current (AC) shall designed and installed in accordance with Israel Electricity Law.

2. At least the following systems shall have representative and service facilities in Israel:

3. Diesel engine, Diesel generator, Brake system, Transmission system, Air condition system, cooling system, Engine cooling system, Hydraulic System, Pneumatic System, Cranes.

4. The representative and service facilities shall be listed.
Attachment E
The protection is by a circuit breaker as we can see in page 173 in the wiring diagram.
- Here mentioned that from the wiring diagram parts that I have, I can't see the source of relay
  (points D1,D2 – May be from an emergency push button.
The system Earthing that offers by the manufacture supply a high current in one phase to ground short
circuit that runs the protection (it is right also for all the short circuit cases).

TN- is Prohibited for use in Israel

2. **The protection systems:**

The protection systems that can be taking in account, but are not practically to use are the TN-S
system (need an electrode and the max electrode resistance to the ground of 20.0 ohm) and the
leakage current monitor ( also need an electrode and the max electrode resistance to the ground
given by the formula $R_e = \frac{U_{ph/2}}{I_a}$ [2])

These Methods are not practically to use.
The System:
A crane railcart for use in the Israel railways Ltd. in the crane electronic and electrical systems, include service outlets in the outside of the crane, charging system, rectifiers system, generator as the main power supply, excluding times when the crane "on board" in the garage.

The Goal: Recommendations about the protection against electric shock method to use in the crane.

1. Description of the system components (that relevant to the ishue):
According to our conversation and the wiring diagram of the crane systems, the type of the supply in the crane is the TN system (the neutral of the generator connected to the crane body that is separate from the earth-Ground). This method Prohibited for use in Israel.
Because of the isolation between the crane and the ground we can't see the system as TN-S.
And the use of ground electrode is not practical in this case.

The power supply: 3 phases generator which connected to a switchboard with 4 pole circuit breaker (NSX100-B-4P).
The main power wiring diagram (page 172):

3. The recommended system: the IT system:
The aim of the system is to prevent a close loop threw a man body in case of fault to the ground.
This system Is characterized by not connecting the generator neutral to the ground (crane body – steel) and the use of an Insulation Monitor.
When the crane in the garage and get the supply from a local board one have to make a by-pass connection to the Insulation Monitor.
This Method is commonly in rail cart as we can see in the appendix.
To use the IT system we have to:

a. Put an Insulation Monitor in the generator ports or in front of the switchboard after the generator ports (if the Probability of short circuit in that section is low).
It is recommended to connect the outlets threw RCD's to protect the workers against a second fault to the ground.

b. Use the crane body as an equipotential bonding.

c. To put a sign in the main board that will note the system method (like: "Take care, the system protection methods is IT")

d. To put a bypass selector to the Insulation Monitor so one can connect the supply from the garage board.

It is highly recommended to put a sign in front of the generator that says: "Do not connect/runs or use as a power supply the generator while the crane is in the garage"